An integrated microfluidic culture device for quantitative analysis of human embryonic stem cells.

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Public Summary:

Scientific Abstract:
We have successfully designed and fabricated an integrated microfluidic platform, the hESC-microChip, which is capable of reproducible and quantitative culture and analysis of individual hESC colonies in a semi-automated fashion. In this device, a serpentine microchannel allows pre-screening of dissociated hESC clusters, and six individually addressable cell culture chambers enable parallel hESC culture, as well as multiparameter analyses in sequence. In order to quantitatively monitor hESC proliferation and pluripotency status in real time, knock-in hESC lines with EGFP driven by the endogenous OCT4 promoter were constructed. On-chip immunoassays of several pluripotency markers were carried out to confirm that the hESC colonies maintained their pluripotency. For the first time, our studies demonstrated well characterized hESC culture and analysis in a microfluidic setting, as well as a proof-of-concept demonstration of parallel/multiparameter/real-time/automated examination of self-renewal and differentiation in the same device.